30. The Comparative Anatomy of the Koala (*Phascolarctos cinereus*) and Vulpine Phalanger (*Trichosurus vulpecula*). By CHARLES F. SONNTAG, M.D., F.Z.S., Anatomist to the Society.

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(Plates V., VI.; Text-figures 53-63.)

The observations recorded here are based on the examination of an adult male *Trichosurus vulpecula* which died in the Society's Gardens, and a young female *Phascolarctos cinereus* which Mr. A. F. Richardson, of Hull, sent to us for examination after death.

The measurements of the Koala are as follows:—

	Centimetres.
Length from tip of nose to root of tail.........	50
,, of head	12·5
,, of tail	2·5
Greatest width of head	7·5
Length of fore limb (arm, 9·5; forearm, 13·5; manus, 4·5)	27·5
Length of hind limb (thigh, 11·5; leg, 12; pes, 5)	28·5

The external characters presented nothing new.

Sir Everard Home, who wrote the first account of the internal anatomy of the Koala, in 1808, described the character of the glandular patch of the lesser curvature of the stomach, and the prostate gland which resembles that of the Kangaroo; he also recorded the absence of the patella (**5**). Eighteen years later Dr. Robert Knox, of Edinburgh, described the long cæcum for the first time, and named the Koala the "Wombat of Flinders" in honour of its discoverer. He also criticised the writings of Home, Illiger, Cuvier, Desmarest, and De Blainville. Since then accounts of the anatomy of the entire animal have been written by Martin (**8**), Forbes (**4**), and Young (**13**), and individual organs have been described by Flower (**3**), Owen (**11**), Macalister (**7**), and Chalmers Mitchell (**9**). The histology of different parts has been described by Oppel (**10**) and Braus (**1**).

THE ANATOMY OF THE HEAD AND NECK.

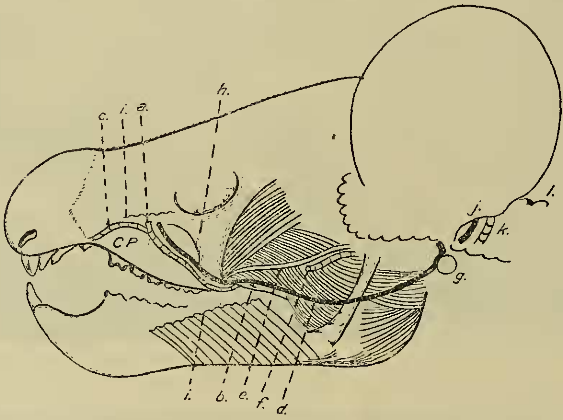
Phascolarctos cinereus.

When the skin of the head is removed it is seen how the platysma myoides, muscles of mastication, auricular muscles, and those round the orbit and mouth are strongly developed.

The *platysma myoides* arises posteriorly from a strong panniculus carnosus. It has a clearly-defined line of attachment to the lips, and some of its fibres fuse with those of the muscles of the angle of the mouth and orbit. It covers the anterior part of the masseter muscle and the facial vessels. It has been divided along the lines *i.i.* in text-fig. 53.

The *masseter muscle* (text-fig. 53) has been described by Macalister. It has a tendinous lower border (*b*), from under cover of which the *facial artery* (*a*) emerges and runs antero-superiorly; it gives off an external nasal branch (*c*) which runs along the antero-superior border of the cheek-pouch (CP). The masseter is crossed by the anterior facial vein (*d*), transverse facial artery (*f*), and Stensen's Duct (*e*).

Text-figure 53.



The side of the head of *Phascolarctos cinereus*.
j. k. posterior auricular vessels; *l.* parotid gland. Other letters in text.

Macalister has described the *attolens*, *attrahens*, and *retrahens* muscles which act on the large auricles.

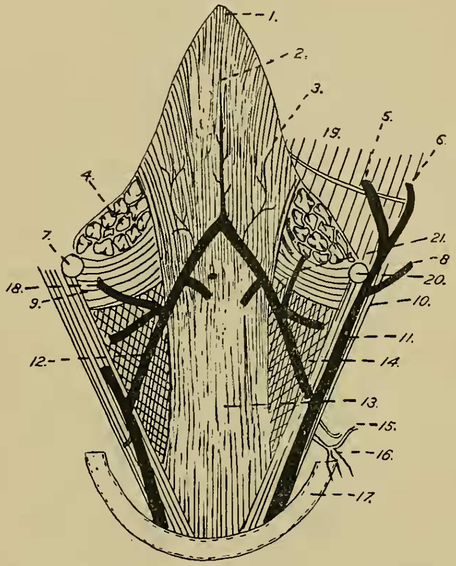
The *anterior facial vein* has the usual origin, course, relations, and branches. It unites with the posterior facial vein on the surface of the exoccipital process (*g*) to form the external jugular vein. No part of it is seen in the interramal space of the mandible, and the *vena transversa* (text-fig. 54, 12), which is long and V-shaped, connects the external jugular veins (11) instead of the anterior facials; it receives lingual, muscular (3, 18), sub-maxillary (21), and a single submental vein (2), but no *anterior jugular vein* connects it to the internal jugular vein.

The *Parotid Gland* is large, and forms a prominent mass in the face and neck. Running on its surface are the posterior auricular vessels.

The neck is divided, as usual, into mesial and lateral triangles by the sterno-mastoid muscle (text-fig. 54, 10), and these have the usual boundaries. The base of the lateral triangle is formed by the clavicle (17) as in all Marsupials except the Peramelidæ, which have no clavicles.

In the space between the mesial borders of the sternomastoids there is a thin muscular sheet formed by the mylo-hyoid (1) anteriorly, the digastrics (9) antero-laterally, and the sterno-hyoids (13) posteriorly; the sterno-hyoids have become separated from the hyoid bone in this specimen, but the whole sheet plays over it. Anterior to the digastrics are the submaxillary glands (4).

Text-figure 54.



The superficial anatomy of the neck of *Phascolarctos cinereus*.
5 and 6. anterior and posterior facial veins; 7, 20. exoccipital process; 8. posterior auricular vein; 11. external jugular vein; 16. supraclavicular nerves; 17. clavicles; 19. masseter. Other numbers in text.

The space between the sheet and the sterno-mastoids is bridged over by a triangular fascia (14) which covers the common carotid artery, vago-sympathetic nerve-trunk, and the nerve to the pretracheal muscles. It does not cover the internal jugular vein, which is under cover of the sterno-mastoid.

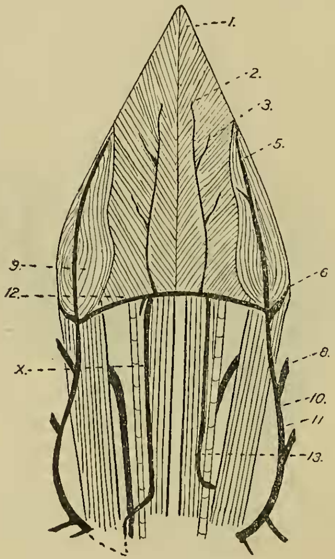
Trichosurus vulpecula (text-fig. 55).

The superficial anatomy differs from that of *Phascolarctos* in the following respects:—

1. The platysma is not so well developed. 2. The external nasal artery does not follow a cheek-pouch. 3. The auricular

muscles are not so powerful. 4. The vena transversa is horizontal, and runs between the anterior facial veins. It is connected to the internal jugular veins (x) and receives two submental veins; a small part of it loops into the interramal space. 5. The sterno-hyoid muscles are attached to the hyoid bone. 6. The superficial sheet between the sternomastoids of *Phascolarctos* is absent. Neither in *Phascolarctos* nor in *Trichosurus* does the vena transversa receive laryngeal veins.

Text-figure 55.



The superficial anatomy of the neck of *Trichosurus vulpecula*.
Numbers as in previous figure.

The deep anatomy of the neck differs greatly in the two species:—

Phascolarctos cinereus.

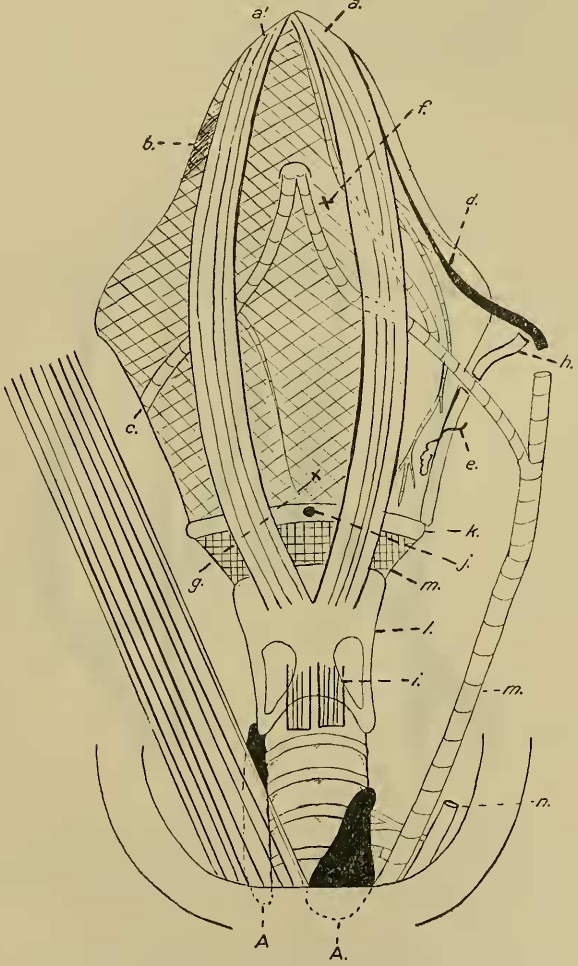
When the muscular sheet described above is removed the conditions shown in text-fig. 56 make their appearance.

The walls of the mouth (f) and pharynx (g) lie immediately under cover of the muscular sheet, and the following structures are seen to lie on their external surface:—

1. Two long, narrow strap-like genio-hyoid muscles (a, a') running from the symphysis menti to be attached to the hyoid bone (m) and larynx (l). They cross the lingual arteries (c). 2. The lingual arteries. 3. The hypoglossal nerves (d). 4. The pharyngeal branches of the vagi (e), which are very tortuous.

A short interval separates the insertions of the genio-hyoid and sterno-thyroid muscles (*i*), which arise from the back of the sternum and third costal cartilages. At the posterior part of the neck the lateral lobes of the thyroid gland (A. A) project from under cover of the sterno-thyroids, and extend for a short distance dorsal to the clavicles.

Text-figure 56.



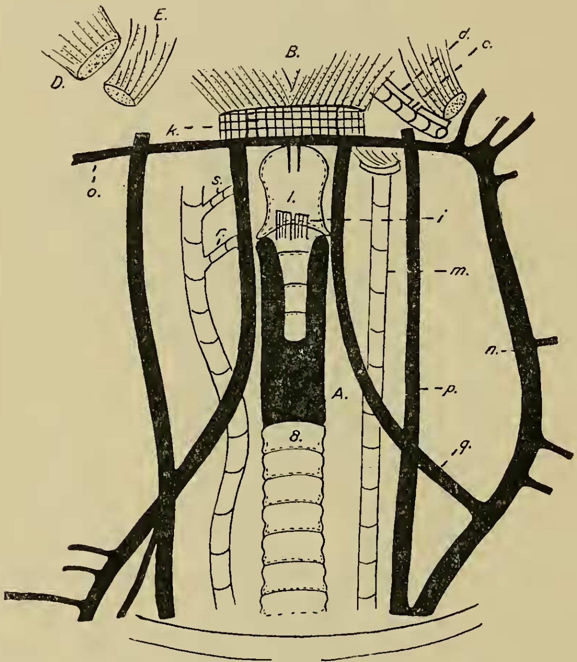
The deep anatomy of the neck of *Phascolarctos cinereus*.
j. level of opening of nasal tube into the pharynx; *k*. thyro-hyal capping the shaded basi-hyal (*m*). Other letters in text.

Macalister (7) described the *styloid group of muscles* as follows:—"The styloid group form a single sheet, the hind fibres of which pass to the pharynx, the middle to the ceratohyal under the stylohyoid ligament; the anterior pass to the side of the tongue."

The *digastrics* have the usual attachment, and they are united by muscular fibres to other muscles around.

The *stylo-hyoid ligament* is loose (text-fig. 56, *h*). The genio-hyoids are connected to the digastrics by muscular slips (*b*).

Text-figure 57.



The deep anatomy of the neck of *Trichosurus vulpecula.*

D. sterno-mastoid; E. digastric; *k.* hyoid bone; *m.* common carotid artery; *n.* external jugular vein; *o.*, vena transversa; *q.* anterior jugular vein; *r. s.* thyroid and laryngeal arteries. Other letters in text.

The *cervical lymphatic glands* form two groups. The first, consisting of a few large glands, is a little posterior to the prominent alisphenoid bullæ The small glands of the second group are around the great veins at the root of the neck.

The distance from the symphysis menti to the level of the angles of the mandible is 6 cm., from the angles of the mandible to the hyoid bone 1·2 cm., and from the hyoid bone to the sternum 6 cm.

Trichosurus vulpecula (text-fig. 57).

The deep anatomy of the neck differs from that of *Phascolarctos* in the following respects:—1. The walls of the mouth and pharynx are more deeply placed under muscles. 2. True hyoglossus muscles are present (B), so the lingual artery (*c*) and hypoglossal nerve (*d*) are more deeply placed. 3. The thyroid gland is applied to the posterior part of the larynx and is far anterior: it does not pass dorsal to the clavicles. 4. The alisphenoid bullæ are not so prominent. The exoccipital processes are not visible. 5. The external jugular vein is formed on the surface of the sternomastoid muscle.

THE RESPIRATORY ORGANS.

In *Phascolarctos* the epiglottis is broad and entire, with an emarginate apex, and each lung contains two lobes; Forbes (**4**) described two left and three right lobes. No azygos lobe is present. In *Trichosurus* the epiglottis is notched; the left lung has two lobes and the right one has four, of which one is azygos. The tracheal rings are wide, but deficient dorsally.

The nasal tube of *Phascolarctos* has no median dorsal ridge, and does not grip the larynx, whose epiglottis is so large that it could only be accommodated by considerable stretching of the orifice of the tube.

In *Trichosurus* the nasal tube has a median dorsal ridge, and it gripped the larynx firmly in my specimen.

Sir Everard Home states that the Koala utters a shrill yell when hungry or hunted, but Owen says that he never heard a note of any kind from the Phalangers.

THE MOUTH.

Phascolarctos cinereus.

The Vestibule.—Fleshy lips are connected to the gums by lax frenums, of which the upper is ·6 and the lower is 1·2 cm. long. The cheeks are attached to the gums opposite the canine tooth and posterior border of the premolar of the upper jaw on each side; between these lie the mouths of the cheek-pouches (Plate V., A) already described by Owen (**11**), Young (**13**), and Forbes (**4**).

Forbes states that "the mucosa of the cheeks is smooth throughout"; but in my specimen it is covered with rounded papillæ, which are all visible to the naked eye. They extend on to the fauces, and for a short distance along the outer walls of the cheek-pouches, but they are absent from the lips whose mucosa is quite smooth. They are not regularly arranged like the papillæ of the cheeks of the Ungulata.

The vestibule and cavum oris communicate through the diastema anteriorly, and behind the last pairs of molar teeth posteriorly; the former of these is wide and the latter narrow.

The Palate (Plate V., A).—The upper incisor and canine teeth surround a small area on which there are six small tubercles, but these do not cover prominences on the premaxillæ. Immediately behind these lies the first of the nine palatal ridges, which are most marked anteriorly. Forbes also described nine ridges, and Young recorded eight. Martin described eight furrows. The anterior ridges are transverse, and are complete or incomplete, but some of the posterior ridges are curved and bear small nodules on their anterior borders.

When the mucous membrane is removed the bony palate is seen to have a sinuous outline when viewed laterally (text-fig. 59, E).

The *soft palate* is long, smooth, and devoid of a uvula.

The *isthmus faucium* (text-fig. 59, *f*) is a circular orifice which admits the tip of the index finger, and the fauces form a septum without the tonsils, which lie far back in the pharynx at a distance of 6 cm. from the incisor teeth.

Trichosurus vulpecula (Plate V., B).

Cheek-pouches are absent, and the vestibule and mouth communicate as in the above. On the palatal area surrounded by the incisor and canine teeth, which form a more perfect arcade than in *Phascolarctos*, there is a median ridge and several small, hard papillæ.

The palatal ridges, of which there are six, are sharper than in *Phascolarctos*, and the anterior ones are convex forwards, with the free edges directed backwards. Between several of the ridges the mucosa is covered with papillæ.

The tonsils have the usual situation in the fauces.

Pseudochirus peregrinus (Plate V., C).

There are eight palatal ridges, most prominent anteriorly, and many papillæ crowd the mucosa between them. Cheek-pouches are absent.

THE TONGUE (text-fig. 58).

Martin (8) states that the tongue of *Phascolarctos* rises abruptly from a furrow surrounding its base, and the distance from its root to the epiglottis is $\frac{7}{8}$ of an inch. I found, however, that it is much farther removed, the distance being slightly more than $1\frac{3}{4}$ inches, and the mucosa of its dorsum is continuous with that of the ventral wall of the pharynx (text-fig. 59, A, *a*).

Measurements:—Total length 5·5 cm.; length of the oral part 5 cm.; length of the pharyngeal part ·5 cm.; greatest width 1·5 cm. The slightly spatulate narrow tongue does not narrow greatly from base to apex.

The Papillæ.—A single prominent *vallate papilla* (text-fig. 58, A) lies in the mid line; it is circular on plan and conical on elevation, with the base of the cone projecting beyond the well-marked fossa; the vallum is rough, granular, and not easily distinguished from the rough surface of the tongue. Martin, Owen, and Forbes each describe a specimen with one papilla.

The *fungiform papillæ* are small, and form a dorsal bounding zone on which they have the usual arrangement in clusters and rows; none are overlapped by the *conical papillæ*, which are small, pointed, and irregular in distribution. On the ventral papillary zone only conical papillæ are found.

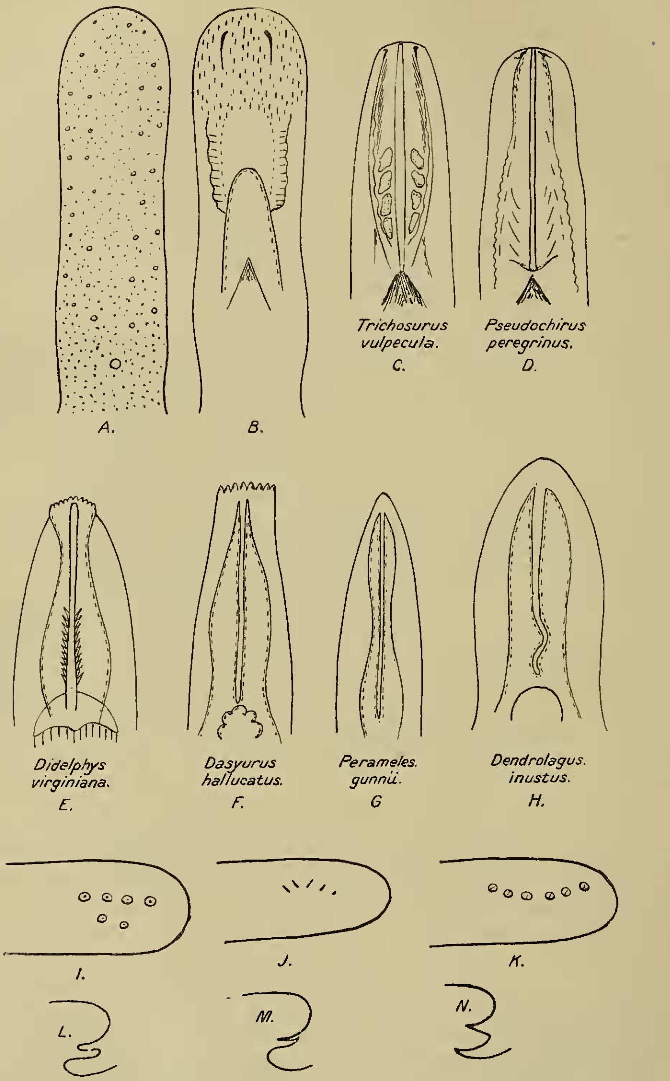
Although there are no *lateral organs* similar to those of the Primates, the posterior extremities of the corrugated lateral borders have circular nodules with well-marked central orifices (text-fig. 58, I); some of these are single and isolated, but others are in small chains. Poulton (**16**) has described similar bodies in *Halmaturus ualabatus*, *Macropus melanops*, and *Petrogale xanthops*, but points out that their arrangement varies; they may be irregular or arranged in curves. He draws attention to their appearances being similar to those of gland-ducts, and suggests that the lateral organs arise from glands; "this view," he states, "is confirmed by a study of minute structure."

No Apical Gland of Nuhn is present, but the glandular mass, as described and figured by Oppel (**10**), sends two long processes forward almost as far as the apex of the tongue. He believes that the Gland of Nuhn, which is present in the tongue of Man and the Orang-Outan, are pieces of the basal glandular mass which have become separated. Perhaps they have become separated off from a prolongation similar to those of the Koala and other Marsupials.

The *inferior surface* is wrinkled and fissured. In the mid line in front there is a well-marked rough area, bounded laterally by fissures. Posterior and lateral to the central area are crenated, transversely-furrowed *plicæ fimbriatæ* (text-fig. 58, B), which increase in width from before backwards.

Many Marsupialia have a sublingua which differs from that of the Lemuroidea in being firmly fixed by its apex to the under surface of the tongue. It varies in size in different species, but that of the Koala is the smallest; it has been reduced to the condition of plicæ fimbriatæ in the same way as the sublingua of the Lemuroidea gives way to the plicæ of the Simiidæ. A few illustrations of the degrees of development in the Marsupialia are shown in text-fig. 58, B–H. The sublingua also becomes softer as well as reduced in size, as in the Primates. Thus there is the complete horny sublingua as in *Lemur*, the softer and smaller sublingua as in *Tarsius*, and the plicæ fimbriatæ as in *Anthropopithecus*.

Text-figure 58.



The tongues of some Marsupials.

A. and B. *Phascolarctos cinereus*; C–H. inferior surfaces of the tongues; I–K. lateral organs of *Phascolarctos, Trichosurus*, and *Pseudochirus* respectively; L–N. vertical sections of the tongues of *Phaseolarctos, Trichosurus*, and *Pseudochirus* showing degrees of freedom of the sublingua.

Trichosurus vulpecula.

Poulton (**16**) described the tongue under the old name of *Phalangista vulpina*, so I shall only mention the differences between it and that of *Phascolarctos*:—1. The epiglottis overlaps the base. 2. Three papillæ form a vallate triangle. 3. The lateral organs consist of fissures and laminæ. 4. The sublingua is a flat horny plate with a strong median ridge and a denticulated apex bound down to the under surface of the tongue (text-fig. 58, C). 5. The two forwardly-directed glandular processes are stouter and relatively shorter.

Pseudochirus peregrinus.

The parallel-sided tongue has the following *dimensions*:—Total length 4·2 cm.; length of the oral part 3·7 cm.; length of the pharyngeal part ·5 cm.; width between the lingual attachments of the palato-glossal folds ·4 cm.

The Papillæ.—Three circular *vallate papillæ* form an equilateral triangle with the apex behind; the basal papillæ are prominent, but the apical one is strongly retracted.

The *fungiform papillæ*, which are small and few in number, form a dorsal bounding zone, but they have no definite arrangement in transverse rows and clusters; they are surrounded by sharp *conical papillæ*, which form transverse rows almost up to the apex of the tongue. Only conical papillæ are present on the ventral bounding papillary zone.

No *orifices of ducts and glands* are seen on the base of the tongue.

The Lateral Organs (text-fig. 58, K).—On each lateral border of the tongue there is a row of circular elevations with central slit-like orifices, so they are not quite similar in appearance to those of *Phascolarctos*. The slits run upwards and backwards. Each organ consists of six areas. On the surrounding mucosa there are many nodules and papillæ.

The Sublingua (text-fig. 58, D).—The most pronounced feature of the tongue is the large, soft sublingua. It is firmly bound to the under surface of the apex, as in all Marsupialia in which it is complete, but its under surface is deeply fissured and separated by a deep gap from the tongue (text-fig. 58, D and N). Running backwards in the mid line is a strongly-developed median crest, which is bounded behind by a fissure.

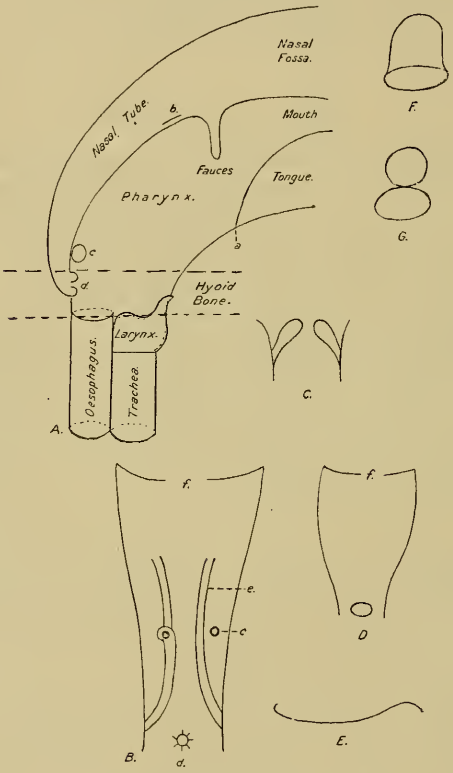
There are great differences, therefore, between the lateral organs, ventral surfaces, and vertical sections of the tongues of these three species, as seen in text-fig. 58, B–D and I–N. The essential differences between the sublinguæ of the Marsupialia and Primates lie in the apices—in the former the apex is fixed to, but in the latter it is free from, the under surface of the tongue.

THE PHARYNX.

Phascolarctos cinereus.

The distance from the fauces to the beginning of the œsophagus is 4·5 cm., and the greatest width of the pharynx, which narrows from before backwards, is 2·2 cm. The mucosa is smooth, and two ridges run along the sides of the mid-dorsal line (text-fig. 59, *e*).

Text-figure 59.



The pharynx of *Phascolarctos cinereus.*
Explanation of letters in text.

The *tonsils* (text-fig. 59, *c*) are small oval bodies in the dorso-lateral aspect of the pharynx, a little distance anterior to the hyoid bone. They appear as pits on the interior of the pharynx, and the right one is surrounded by a prominent ridge.

The *naso-pharynx.*—The nasal fossæ are prolonged backwards by a conical tube, which opens on the mid-dorsal wall of the pharynx by a small circular orifice guarded by two fleshy cushions (text-fig. 59, A *d* and C). It has no mesial dorsal ridge as in

Trichosurus and *Pseudochirus*. The opening lies within the hyoid ring about 5 mm. anterior to the beginning of the œsophagus, so the naso-pharynx is exceedingly small. This is a remnant of the condition present in the new-born animal. Owen **(11)** describes how the larynx is gripped by the nasal tube in the mammary fœtus of the Kangaroo, and the milk stream is divided by the larynx, which crosses the pharynx; he gives illustrations.

Sections through the head and neck at different levels show how the shape of the nasal tube alters from before backwards (text-fig. 59, F and G).

The *Eustachian Tubes* (text-fig. 59, *b*).—The lower orifices of the tubes are slit-like, and lie on the infero-lateral aspects of the nasal tube at a distance of 2·9 cm. posterior to the hard palate, and at a point about 1 cm. posterior to the fauces. In Plate V. pins are inserted into the inferior orifices of the Eustachian tubes.

Trichosurus vulpecula.

The pharynx differs from that of *Phascolarctos* as follows:—

1. The tonsils are in the fauces.
2. There is a ridge on the dorsal wall of the nasal tube, but none in the pharynx.
3. The larynx crosses the pharynx and enters the nasal tube.

The nasal tube of *Pseudochirus* has a median dorsal ridge (Plate V., C).

THE ŒSOPHAGUS.

Phascolarctos cinereus.

The *cervical part* (4·3 cm. long) is entirely concealed by the larynx and trachea, and its mucosa is smooth throughout. The *thoracic part* (7·8 cm. long) has small longitudinal folds on its inner surface. The *abdominal part* (1·8 cm.) is lined by mucosa thrown into prominent longitudinal folds. At the point where it emerges from the posterior surface of the liver it is in contact dorsally with the right suprarenal capsule.

Trichosurus vulpecula.

The œsophagus projects beyond the left border of the trachea in the neck, and it has a longer course (=3 cm.) in the abdomen than has that of *Phascolarctos*. It is not in contact with the right suprarenal capsule. In some examples its abdominal part is much shorter, however.

THE PERITONEUM.

Phascolarctos cinereus.

The *great omentum* is devoid of fat, but contains a well-marked arterial arcade formed by a branch of the splenic artery and a twig from the arterial ring round the pyloro-duodenal junction (text-fig. 60, B, *a'*). There is nothing new to record about its attachments.

The *lesser omentum* has a **T**-shaped attachment to liver and stomach (text-fig. 60, A, *a*). The horizontal limb lies along the lesser curvature, and the vertical limb runs back along the ventral surface of the stomach.

The great omentum of *Trichosurus vulpecula* is well laden with fat.

THE STOMACH.

Phascolarctos cinereus.

The observations recorded here are supplementary to the descriptions by Martin (**8**), Young (**13**), Forbes (**4**), Edelmann (**2**), Flower (**3**), and Home (**5**).

The long axis of the sac-like stomach, which lies in the epigastrium and left hypochondrium, runs posteriorly, ventrally, and to the right, and the well-marked fundus is directed forwards and to the left. Projecting from the greater curvature immediately below the pyloric cylinder is a sac whose walls are thinner than those of any other part of the stomach.

Relations :—

Anteriorly—liver and right suprarenal capsule.

Posteriorly—spleen, intestines, solar plexus, left kidney, and suprarenal capsule.

Right—duodenum, gall-bladder.

Left and ventral—abdominal parietes.

Dorsal—crura of the diaphragm, aorta, pancreas, right kidney, inferior vena cava.

Measurements :—

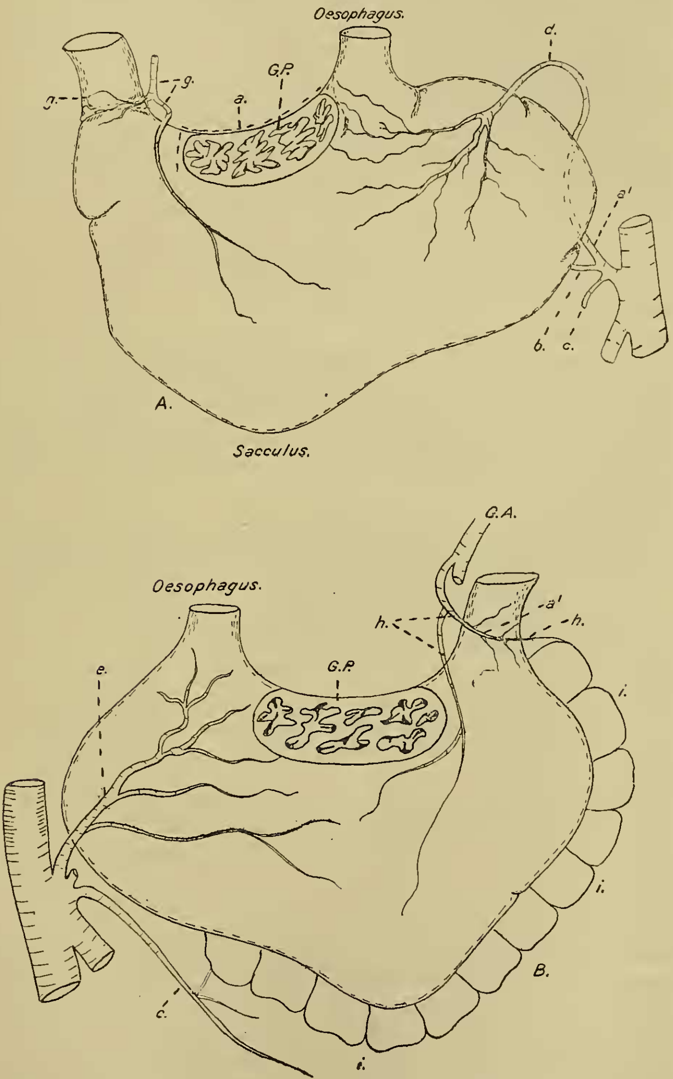
Total length	7 cm.
Length of fundus	2·2 ,,
Width between curvatures	3·7 ,,
Lesser curvature	2·2 ,,
Length of pyloric tube..................	1·6 ,,

Arteries (text-fig. 60).—The stomach receives its blood supply from the three branches—gastric (*a'*), hepatic (*b*), and splenic (*c*) —of the cœliac division of the cœliaco-mesenteric artery (see page 570), and each vessel is accompanied by fine nerves derived from the vagus and solar plexus (text-fig. 60, A).

The gastric artery divides into a large ventral branch (*d*) and two dorsal branches (*e*)—large and small. The former, after a straight course towards the stomach, breaks up into many tortuous vessels ramifying over the fundus, and some can be traced into the left side of the gland-patch. The latter make a similar vascular arrangement on the dorsal aspect of the fundus, and supply the patch as well.

The hepatic artery gives off a large gastric branch (G. A.) which divides into four—two dorsal (*g. g*) and two ventral—branches (*h. h*). Each pair supplies one surface of the stomach,

Text-figure 60.



The ventral (A) and dorsal (B) surfaces of the stomach of *Phascolarctos cinereus* with arteries.

and forms half of a vascular ring encircling the pyloro-duodenal junction. They supply the gastric wall and gland-patch. The pyloro-duodenal ring communicates with the mesenteric arteries, and a twig forms a long arcade (*iii*) in the great omentum with a branch of the splenic artery; this arch gives off vasa brevia, which enter the stomach-wall vertically (text-fig. 60, B).

There is no continuous vessel or arcade on the lesser curvature, for the gland-patch interrupts it.

The *veins* enter the portal and splenic veins.

The *gastric nerves* (text-fig. 63, V.G.P.) form a complex plexus on the left side of the gland-patch, and are intermingled with branches of the gastric artery, and fine nerves reach the stomach along branches of the hepatic artery. They will be described later along with the solar plexus and vagus nerves. The nerves reach the interior along the course of the arteries.

The *interior of the stomach* (Plate VI., A) was briefly described by Martin (8). Apart from the enumeration of the orifices of the gland-patch by several authors, no other description of the interior has been published.

The long axis of the oval gland-patch, which lies along the lesser curvature of the stomach, is 2 cm. long, and the width is 1·7 cm. Its inner surface has thirty orifices of different sizes, arranged in rows at right angles to the long axis of the patch. In addition to these the lens reveals how the surface of the patch is finely-pitted.

The remainder of the inner surface is traversed by rugæ radiating from the edges of the gland-patch like the spokes of a wheel. Those running towards the lower end of the œsophagus are short and Y-shaped; those passing into the fundus and body of the stomach are at first straight but undulating later; none are present in the sacculus on the greater curvature; and those passing to the pylorus are few in number, but stronger than in other parts.

The musculature of the pylorus thins out on the walls of the sacculus, and that of the œsophagus thins out on the fundus and lesser curvature.

The gastric contents consisted of a viscid creamy chyme, and they resembled the contents of the stomachs of two Langurs which I examined. In the Sloth, on the other hand, as I showed in a previous paper, the stomach contained many hard, almost entire leaves.

Special gastric glandular apparatus is also present in the Wombat, Beaver, Dormouse, Manatee, and Dugong. It was also present in the now exterminated Steller's Sea-Cow (*Rhytina stelleri*). Knox thought that the apparatus in the Sirenia was an electric organ, and traced the two vagus nerves into it.

The pylorus projects into the duodenum (Plate VI., B), as in Man. The human form has been likened to the projection of the cervix uteri into the vagina. The free surface is rough and villous.

Trichosurus vulpecula.

The stomach differs from that of *Phascolarctos* in the following respects:—

1. It is more globular.
2. There is no sacculus on the greater curvature, but the stomach projects to the right of the pylorus.
3. The gland-patch is not present on the lesser curvature.
4. The pylorus is not such a well-defined cylinder, and does not project into the duodenum as in Man and *Phascolarctos*.
5. The walls of the stomach are relatively thinner.
6. The mucous membrane is rough, but has no rugæ.

In a hitherto unpublished note Garrod states that the fundus of *Cuscus maculatus* has a reticulum of rugæ.

THE INTESTINES.

Phascolarctos cinereus.

The external and internal characters have been fully described by Forbes and Chalmers Mitchell (**9**), and I have nothing to add to their accounts. My measurements differ greatly, however, from those recorded by various authors. The figures in the following table represent inches, and the asterisks denote that fresh specimens were examined. Lönnberg's specimen was a mammary fœtus*. If due allowance is made for shrinking induced by preserving fluids, it will be seen that the lengths of the different parts of the intestinal tube vary greatly in individuals, and have no relation to the length of the animal:—

	Length of animal.	*Small intestines.*	*Large intestines.*	*Cæcum.*
*Knox (1826)	23	92	128	77
Martin (1836) ♀	not given	not given	76	50
Owen (1837)	23	92	125	77
*Forbes (1881) ♀	17	115	93·25	46·75
Forbes (1881) ♀	20·5	111·5	160·8	66
Lönnberg (1902)	3·5	14·55	11·45	3·4
*Sonntag (1921)	21	54·5	75	36

Lönnberg (**17**) compared the measurements of the different parts of the intestinal tract of *Phascolarctos* and several other Marsupials, and he also compared those of the fœtal and adult intestines, taking Forbes's figures as the standard for the latter. He came to the following conclusions:—". . . . the difference is quite striking with regard to the cæcum and the large intestine. The former is proportionately only about a third as long in the fœtus as in the full-grown animal, and the latter less than half as large in the fœtus as in the adult. The difference of the small intestine in both stages is not so great, that of the fœtus being about four-fifths of the same in the adult. It is also to be remarked that in the fœtus the small intestine is considerably longer than the colon, but in the adult the reverse is the case. The differences can of course be ascribed to the difference of the diet of both stages. The milk food of the mammary fœtus is chiefly or completely digested in the small intestine, but the vegetable diet of the adult needs a greatly developed cæcum and colon. The longitudinal folds of the cæcum and colon are, however, already developed in the fœtus."

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* The mammary fœtus is the new-born animal fixed to the nipples in the pouch.

It is possible that the growth of the intestinal tract in my specimen has been considerably retarded.

Ellenberger, Tullberg, and Lönnberg believe that the large size of the cæcum in many animals, such as the Horse, Koala, and some Rodents, is brought about by the presence of a large amount of cellulose in the diet; and when the small intestine deals with all the elements of the food, there is no specialisation in the cæcum and colon. Lönnberg also speculates about the great length of the small intestine in phyllophagous Mammals. He states that the leaves consist of cellulose and certain protoplasmic, amylaceous, and other substances contained within resistant envelopes. Some time must elapse, therefore, before these are broken down and their contents become available for digestion and absorption; the small intestine is, consequently, long.

Lönnberg's views, however, will not account for the conditions present in the intestinal tract of the phyllophagous Three-toed Sloth (*Bradypus tridactylus*). In my paper dealing with its anatomy (**18**), I showed that the intestinal tract is short, the cæcal pouch is rudimentary, and the interior of the colon and rectum offers a large absorptive area, due to the excavation and folding of the mucous membrane; it possesses sphincters which are similar in character to, but larger than, those of the cæcum of *Trichosurus vulpecula*, and its muscular coat, which thickens from before backwards, may have a similar function to that of the cæcum of *T. vulpecula*.

Although the stomach of *B. tridactylus* contains many hard, almost entire leaves, the intestinal tract contains none, so the cellulose and hard materials have been completely comminuted and reduced to the state of chyme; Rapp's analogies are interesting in this connection, for he likens the paunch and pylorus to a crop and gizzard. This thorough digestive process must throw less work on the small intestines, which, in consequence, are short.

The chyme yields a number of substances for absorption in the small intestines, and the remainder is absorbed from the large intestines, whose pockets and sphincters retain it in the colon and rectum, and the muscular coat moves it backwards and forwards; and the sphincter ani has a retaining function similar to that of the septa higher up in the colon.

The differences between these two phyllophagous Mammals must therefore be due to complexity of the stomach and the different varieties of specialisation of the interior of the colon and rectum, but the increased internal surface of the colon and rectum of the Sloth is compensated for by the large size and great length of those of the Koala. The Langurs are intermediate in the complexity of their intestinal tract between the Sloth and Koala.

In *Phascolomys mitchelli* the cæcum is considerably reduced, and Lönnberg believes that the colon has become considerably enlarged to take on the cellulose-digesting function of the cæcum. The stomach is simple as in the Koala, so it has not had any modifying influence on the complexity of the intestinal tract as in the Sloth. The Wombat has external sacculi, but the Sloth has internal cavities, so there is a greater similarity between their colons than exists between the colon of either of these animals and that of the Koala.

I have already shown how the complexity of the stomach is also influenced by the degree of development of the buccal organs (**19**). One must take a wide view of the whole alimentary canal from mouth to anus in framing an explanation of the physiology of any one part.

The Urinary Organs (text-fig. 61).

Phascolarctos cinereus.

The *right kidney* is 3·2 cm. long, 1·8 cm. wide, and 1·6 cm. thick; it lies entirely anterior to the *left kidney*, whose corresponding measurements are 3·7, 2·4, and 1·5 cm.; its hilum is ventral in position, whereas that of the left kidney is mesial. The structures in the hilus have the usual disposition in regard to one another.

On section each kidney is seen to possess a thin cortex, and a single large papilla.

The surface of each renal pelvis and hilus is covered by a plexus of small veins. These communicate posteriorly with the veins ascending along the ureter, and they open anteriorly into the renal vein.

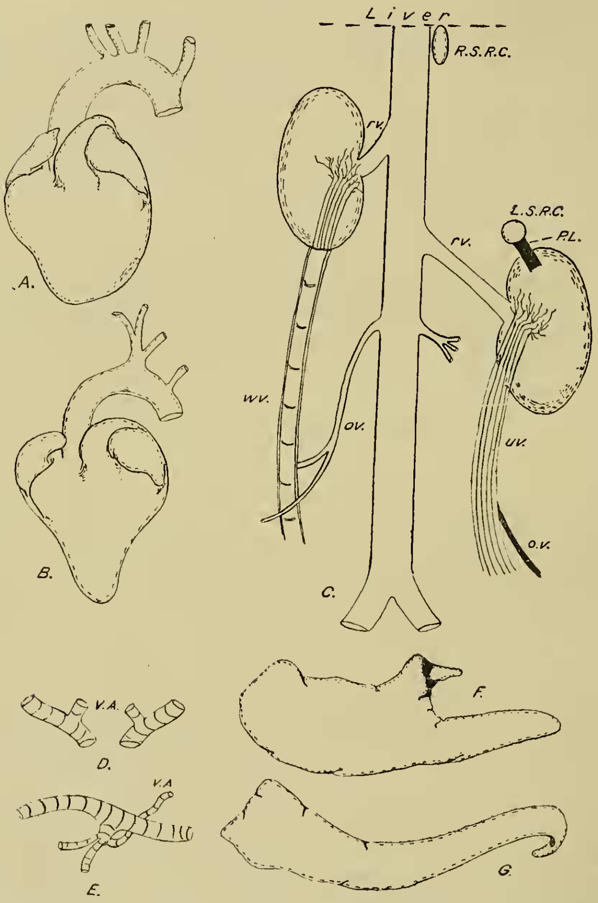
The *right ureter* lies parallel to, but 1 cm. to the right of, the vena cava inferior. It passes ventral to the iliac vessels and runs posteriorly along the dorsal pelvic wall. It opens into the lower and back part of the bladder.

It is accompanied by small veins from the pelvis; the latter are joined by veins from the ovaries, after which a ladder-like arrangement of veins runs up to the venous plexus on the ventral surface of the renal pelvis (text-fig. 61 C, *wv*).

The *left ureter* runs along the left border of the abdominal aorta, crosses the iliac vessels, and courses through the pelvis as does the right one. The veins accompanying it are numerous and some of them ramify; so dense is the venous plexus that the ureter is concealed by them. At first sight it looks like a cord of veins.

John Hunter (22) showed that the relative positions of the kidneys of *Petaurus taguanoides* are similar to the above.

Text-figure 61.



A. heart and aorta of *Phascolarctos cinereus* with origins of right subclavian, right common carotid, left common carotid, and left subclavian arteries, from right to left, and described in text as *a*, *b*, *c*, *d*: B. heart and aorta of *Trichosurus vulpecula*: C. kidneys and some of the abdominal veins: L.S.R.C. and R.S.R.C., suprarenal capsules; P.L., peritoneal ligament: D and E. origins of vertebral arteries in *Phascolarctos cinereus* and *Trichosurus vulpecula* respectively: F and G. spleens of *Trichosurus vulpecula* and *Phascolarctos cinereus* respectively.

The *bladder* is pyriform and firm, but no urachus is seen. Lateral peritoneal folds connect it to the pelvic wall, but no other ligaments are present.

Trichosurus vulpecula.

The anterior half of the right kidney is received into a deep recess in the liver, and its posterior pole is level with the hilus of the left kidney. The bladder is transversely corrugated on the surface and no urachus is present. Only one wide renal papilla is present in each kidney.

GENERATIVE ORGANS.

I have nothing to add to existing accounts of the generative organs of either species.

THE PANCREAS.

The duct is dead-white in *Phascolarctos* and shines through the translucent brown glandular tissue. The latter in my specimen has the same appearances as those described by Martin (**8**).

THE LIVER.

Phascolarctos cinereus.

Forbes (**4**) described and figured the liver, and Braus (**1**) described its histology.

The *hepatic artery* is very convoluted, and divides into two terminal convoluted branches which diverge at the sides of the gall-bladder. From the left branch a straight, slender cystic artery runs in the free edge of the vesical mesentery to the gall-bladder, which it reaches about its middle; then it runs posteriorly along the surface of the gall-bladder as far as the fundus.

The *postcaval vein* is never deeply embedded in the hepatic substance, and receives three hepatic veins at its emergence from the anterior surface of the liver. A fourth vein enters it within the organ.

The *common bile-duct* does not exhibit cysts of its mucous membrane similar to those of some Marsupials described by Owen (**11**).

Trichosurus vulpecula.

The liver differs from that of *Phascolarctos* as follows:—1. It is not so compressed antero-posteriorly. 2. Its edges are not notched by many small fissures. 3. The hepatic tissue is not so subdivided. 4. The right lobe recesses the anterior half of the right kidney. 5. The gall-bladder is shorter and broader, and only projects for a short distance into the abdominal cavity beyond the posterior edge of the right lobe when fully distended with bile.

The Ductless Glands.

Phascolarctos cinereus.

The *Thyroid Gland* (text-fig. 56, A, A).—The two lateral lobes are unconnected, and vary in shape and extent. The *left lobe* is pyriform, with the broad extremity posterior and slightly within the thorax. It is 2 cm. long, ·8 cm. wide, and ·3 cm. thick. It is separated from the larynx by the first three tracheal rings. The *right lobe* is elongated and ovoid, and measures 2·7 × ·5 × ·3 cm. Its anterior extremity overlaps the lower end of the larynx, and its posterior pole stops anterior to the thorax. The *arterial supply* comes from the thyroid and laryngeal branches of the common carotid artery (*m*), and the *veins* run to the internal jugular vein (*n*).

I did not observe any structures which could be definitely described as *parathyroid bodies*, but they may have been lying among the small glands which are numerous at the root of the neck.

The *Thymus Gland* has been described by Symington (**15**).

The *Suprarenal Capsules* (text-fig. 61, S.R.C.).—The left capsule is a round body, of the size of a large pea, lying on the mesial aspect of the anterior pole of the left kidney, to which it is attached by a fold of peritoneum. The right capsule is oval, and has a peculiar position; it lies in contact with the posterior surface of the liver, and is situated between the inferior vena cava to the right, the right crus of the diaphragm to the left, and the œsophagus ventrally.

The greater part of each capsule is composed of brown medulla.

The *spleen* has been described by Martin (**8**).

My specimen is triangular and measures 7·4 cm. long, but that of *Trichosurus vulpecula* has a lateral process (text-fig. 61, F and G). In *Phascolomys* it is an equilateral triangle.

Trichosurus vulpecula.

The lateral thyroid lobes (text-fig. 57 A) measure 1·3 cm. long and ·3 cm. wide. They lie at the sides of the posterior extremity of the larynx and anterior seven tracheal rings. The connecting isthmus crosses rings 5, 6, and 7.

The thyroid artery describes a curve, with the convexity forwards, and runs along the anterior five-sixths of the mesial border of its corresponding lateral lobe. The thyroid vein runs to the internal jugular vein (*p*). This arrangement of the thyroid vessels is seen in animals belonging to several of the Mammalian orders.

THE ORGANS OF CIRCULATION.

Phascolarctos cinereus.

The Heart (text-fig. 61, A).—The fibrous pericardium is firmly bound to the dorsal surface of the sternum and left ribs by connective tissue. It narrows out and is lost on the great vessels. These conditions are also present in *Trichosurus vulpecula*. The area of adhesion is greater than that of *Dendrolagus ursinus*.

The long axis of the heart is antero-posterior and parallel to the left side of the sternum, and the apex is level with the posterior border of the fourth left costal cartilage. Its apex is more obtuse than that of *Trichosurus vulpecula* *.

Measurements :—

	Phascolarctos.	*Trichosurus.*
Length	4·6 cm.	3 cm.
Greatest width	2·4 ,,	2·2 ,,
Greatest thickness ...	1·9 ,,	1·5 ,,

The characters agree with those already described for the Marsupial heart.

The *Ascending Aorta* (text-fig. 61 A) is embraced by the two parts of the right auricular appendix, and is parallel to the right precaval vein. It quickly gives way to the *aortic arch*, whose most anterior point is level with the anterior end of the first intercostal space. At the level of the fourth dorsal vertebra it gives way to the descending aorta; this is the commonest level for the transition in the Mammalia. The relations of the arch are :—

Ventral.—Left lung, left precaval vein, left azygos vein, left vagus nerve, left phrenic nerve.

Dorsal.—Trachea, œsophagus.

Posterior.—Root of left lung.

Anterior. — Great vessels of head, neck, and fore limbs. Branches :—The right subclavian (*a*), right common carotid (*b*), and left common carotid (*c*) arise directly, and close to one another, from the aortic arch, so there is no innominate artery. After a short interval the left subclavian artery is given off (*d*). Martin (**8**) and Owen (**11**) describe an arrangement similar to that of Man, but Forbes (**4**) states that the innominate artery gives off three vessels close together from a common trunk. In *Trichosurus vulpecula* the aortic arch gives off the innominate and left subclavian arteries, and the former, after giving off the left common carotid, divides into right common carotid and right subclavian arteries; the left common carotid arises almost at the beginning of the innominate artery.

The *Common Carotid Arteries* give off fine entocarotids at the level of the anterior border of the hyoid bone, and are continued as stout ectocarotids. The former give off no branches in the neck, and enter the carotid foramen in the basisphenoid. The latter pass antero-laterally between the exoccipital process and the mandible, and the former separates it from the external jugular vein. In *Trichosurus vulpecula* the exoccipital process does not separate these vessels.

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* Some specimens of *Trichosurus vulpecula* have a more obtuse cardiac apex than the above.

The *Descending Thoracic Aorta* lies first on the right half of the body of the fifth dorsal vertebra, but passes more to the right as it runs backwards through the thorax. It is connected to the œsophagus by a triangular fold of pleura, whose base is attached to the diaphragmatic pleura. It has the usual relations and gives off the usual branches.

The *vertebral arteries* come off from the subclavians, but in my specimen of *Trichosurus* they arise from axes (text-fig. 61, E).

The Abdominal Aorta differs from the common Marsupial condition in that it is entirely to the left of the postcaval vein. Hochstetter (20) examined several species, and found that the postcaval vein concealed the lower end of the aorta in all but *Petaurus taguanoides*, but he did not include *Phascolarctos cinereus* in his list. Beddard (21) also found the postcaval vein covering the aorta in all his species. My observations on *Trichosurus vulpecula* and *Dendrolagus ursinus* confirm those of Hochstetter and Beddard.

Relations.—At the point where the abdominal aorta reaches the level of the posterior surface of the liver, it is separated from the right suprarenal capsule by the right crus of the diaphragm. These structures separate it from the postcaval vein.

A little posterior to the capsule the solar plexus lies between the aorta on the left, the postcaval vein on the right, and the cœliaco-mesenteric artery ventrally.

Posterior to the solar plexus the postcaval vein lies immediately to the right side of the aorta till the latter divides into the internal iliac and mid-sacral arteries, and then the vein crosses the surface of the aorta. The whole trunk of the aorta is visible.

The relations to other structures show nothing unusual.

Branches.—With the exception of the four pairs of *lumbar arteries* which arise at regular intervals from the sides, the following is the order of the branches from before backwards:—

Phrenics, cœliaco-mesenteric, suprarenals, renals, ovarians, external iliacs, internal iliacs, and middle sacral (caudal).

After giving off the external iliac arteries, the trunk of the aorta diminishes in calibre to a little more than half of that of either of the external iliac arteries.

The *Cœliaco-mesenteric Artery* divides into cœliac axis and anterior mesenteric artery, and a branch of the latter replaces the posterior mesenteric branch of the abdominal aorta of the higher Mammalia.

The *cœliac axis* divides into gastric, hepatic, and splenic arteries, whose distribution has already been described.

The *anterior mesenteric artery* describes a curve, convex forwards and to the right, and terminates in the cæcum; it occupies the free edge of the cæcal mesentery in the latter part of its course.

The branches supplying the large intestines arise from the convexity of the curve, and those destined for the small intestines are given off from the concavity. The highest branch anastomoses with the duodenal branches of the hepatic artery, and the lowest one anastomoses in the pelvis with the hæmorrhoidal vessels. The lowest branch to the ileum anastomoses with the branches to the cæcum.

The mesenteric areas between the branches of the mesenteric artery contain rich networks of fine lymphatic vessels, and fine branches of the solar plexus accompany the arteries. The *mesenteric veins* have been figured already by Chalmers Mitchell (**9**).

In *Trichosurus vulpecula* the cœliac axis arises separately.

The Veins.

The *Anterior and Posterior Facial Veins* have the usual formation, course, and tributaries. They unite to form the *external jugular vein* on the surface of the exoccipital process. The latter runs postero-mesially across the sternomastoid to reach its lateral border in the posterior sixth of the neck. It passes dorsal to the posterior end of the sterno-mastoid and clavicle, and, anterior to the neck of the first rib, it unites with the axillary vein to form the precaval vein. Both veins are united by a long **V**-shaped vena transversa. In *Trichosurus vulpecula* the vein is more transverse (text-fig. 55).

Tributaries.—Auriculo-temporal, acromial, transverse scapular, muscular, ascending cervical and internal jugular veins. These vessels have the usual distribution. No anterior jugular vein is present.

The *vena transversa* receives veins from the tongue, submaxillary glands, and muscles of the mylo-hyoid region.

At the point where the internal and external jugular veins unite there are several small glands.

The *innominate and precaval veins* follow the usual course of the Marsupial type, and the *azygos veins* in my specimen are similar to those described by Forbes (**4**). The intrathoracic part of the *postcaval vein* measures 1·5 cm.

The *postcaval vein* is formed in the usual manner, but the only part lying ventrally superficial to the abdominal aorta crosses the termination of the latter. This arrangement is an exception to Beddard's statement that "the Marsupials show a very constant condition in that the postcava lies medianly ventral to the aorta, so that on dissection the aorta is not seen, being completely covered by the postcava" (**21**).

It lies to the right side of the aorta, and close to it till it reaches the right renal vein. After that it bends to the right and enters the liver. At the point where it disappears from view it is in contact with the right suprarenal capsule, and is accompanied by twigs from the right half of the solar plexus.

The *left ovarian vein* (text-fig. 61 C, *ov.*) joins the thick venous plexus running along the ureter; therein it is united to veins ascending from the pelvis. The *right ovarian vein* communicates with the right ureteric veins by a stout trunk, and then runs forwards to join the postcaval vein. The *ureteric veins* (*uv.* and *wv.*) form a plexus on the ventral surfaces of the renal pelves and open into the renal veins (*rv.*).

THE NERVOUS SYSTEM.

The *brain* has been described by Owen (**11**), Forbes (**4**), Elliot Smith (**12**), and Ziehen (**14**), and I have nothing to add to their accounts.

THE VAGUS NERVES (text-figs. 62 and 63).

Phascolarctos cinereus.

A short distance posterior to the base of the skull the vagus nerve on each side receives the hypoglossal (XII.) nerve, and their fibres intermingle in a very thorough manner. Soon they separate again, and the vagus runs postero-mesially as far as the anterior extremity of the thyroid cartilage, where it unites with the cervical sympathetic cord (C.S.) to form a vago-sympathetic (V-S.). A short distance anterior to the clavicle it separates again into vagus (V.) and sympathetic (S.).

This arrangement is present in most of the Carnivora. It differs from that of *Dendrolagus*, in which the vagi and sympathetics remain separate.

There is no trace of the ganglion of the trunk of the left vagus (ganglion nodosum) in the neck. The right nerve has one (G.N.).

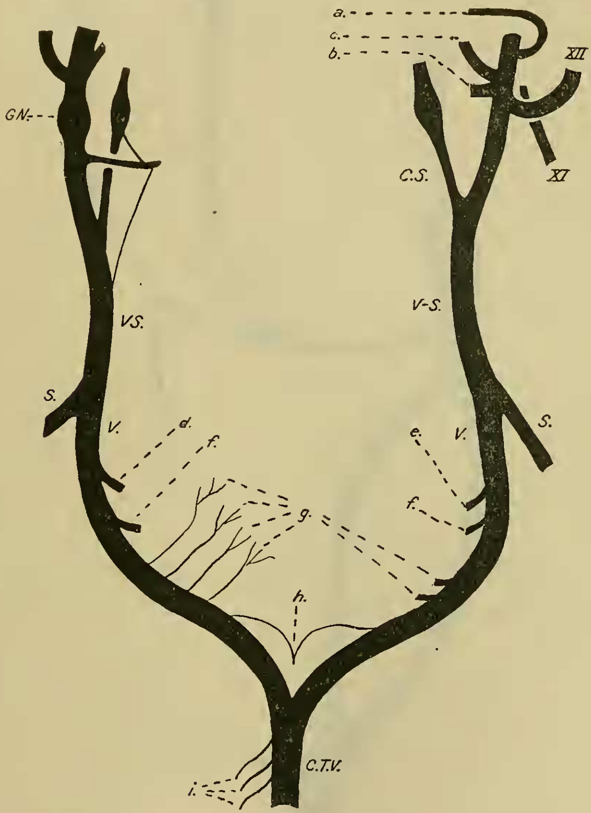
Branches in the neck.—Pharyngeal (*a*), anterior laryngeal (*b*), communicating to the first cervical nerve (*c*), and recurrent branch of the right vagus (*d*).

The relations of the vagi in the thorax differ. The *left nerve* crosses superficial to the left subclavian artery and aortic arch, lying on the inner side of the left precaval vein and left phrenic nerve, and on the outer side of the trachea, œsophagus, and left common carotid artery. It passes dorsal to the root of the left lung and gains the dorsal aspect of the œsophagus. The *right nerve* crosses the right subclavian artery under cover of the right precaval vein, runs down the side of the right main bronchus, and gains the dorsal aspect of the root of the right lung; lastly it passes to the dorsal aspect of the œsophagus, where it fuses with the left nerve to form the combined trunk of the vagi (C.T.V.).

Branches of the separate nerves in the thorax.—Left recurrent laryngeal nerve (*e*), cardiac (*f*), pulmonary (*g*), and a branch from each nerve which unites with its neighbour to form a fine cord, which runs posteriorly along the ventral surface of the œsophagus (*h*).

The combined trunk of the vagi enters the abdomen dorsal to the œsophagus, runs dorsal to the stomach, and ends in the left half of the solar plexus. It gives off ventral gastric nerves in the thorax (*i*), and stout ventral (*j*), and strong dorsal (*k*), gastric nerves in the abdomen.

Text-figure 62.

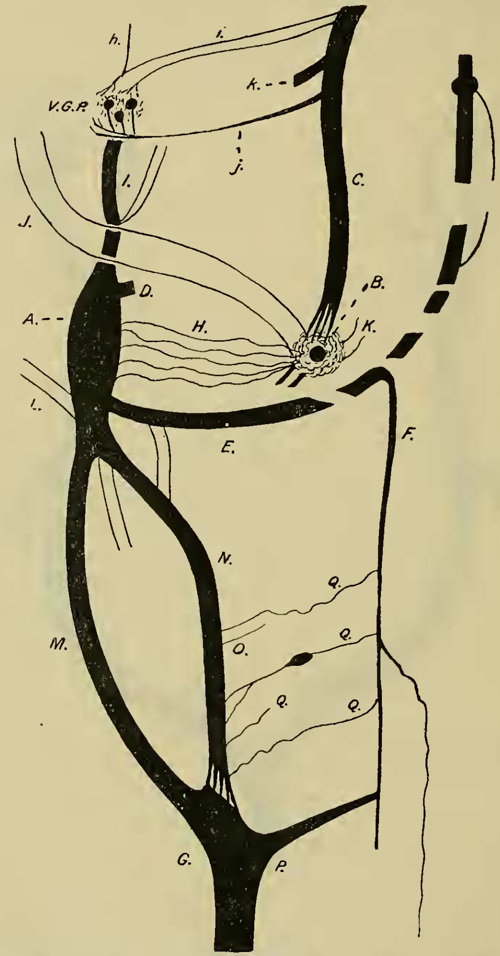


The vagus nerves of *Phascolarctos cinereus* in neck and thorax.

It is possible that sympathetic filaments run anteriorly from the solar plexus to the stomach in the combined trunk of the vagus, for it has been shown that sympathetic filaments run in other nerves (*e. g.* the sciatic).

The two halves of the solar plexus (text-fig. 63) lie between the abdominal aorta and postcaval vein under cover of the origin of the cœliaco-mesenteric artery. The right half (A) is a fusiform ganglion, but the left half (B) consists of a nerve plexus with a small round ganglion. The combined trunk of the vagi (C) enters the left half of the plexus by a brushwork of nerves. The right and left sympathetic nerves (D and E) end in the right half of the plexus, but the left sympathetic gives off

Text-figure 63.



The vagus nerves and abdominal sympathetic of *Phascolarctos cinereus.*

a fine nerve (F), which enters into the formation of the aortic plexus farther back (G). Fine fibres (H) connect the halves of the plexus.

Branches of distribution:—

1. Three nerves which course along the postcaval vein and embrace the right suprarenal capsule (I).
2. Hepatic plexus (J).
3. Splenic plexus (K).
4. Right renal plexus (L).
5. Two cords (M and N) which emerge from the posterior end of the right half of the plexus and form a loop lying dorsal to the postcaval vein. The left one breaks up into a number of fibres which reunite later with the right one, and it gives off the left renal plexus (O).

The loop unites with the left sympathetic by a T-shaped junction (P), and fine filaments (Q, Q, Q, Q) also run between them.

Only one cervical sympathetic ganglion—namely the superior one—exists.

SUMMARY.

The differences between *Phascolarctos* and *Trichosurus* may be summarised as follows:—

Phascolarctos.	*Trichosurus.*
1. Platysma myoides strong.	1. Platysma weaker.
2. No true hyoglossus muscle.	2. Hyoglossus present.
3. Vena transversa Λ-shaped.	3. Horizontal.
4. Absent.	4. Anterior jugular vein present.
5. Lateral organs of tongue look like glands.	5. Composed of fissures and laminæ.
6. One vallate papilla.	6. A vallate triangle.
7. Plicæ fimbriatæ present.	7. Sublingua well developed.
8. Cheek-pouches present.	8. Absent.
9. All anterior palatal ridges transverse.	9. Anterior palatal ridges convex forwards.
10. Tongue far from epiglottis.	10. Close to epiglottis.
11. Epiglottis broad and entire.	11. Narrow and notched.
12. Gland-patch in stomach.	12. Absent.
13. Pylorus projects into the duodenum.	13. Pylorus does not project.
14. Tonsils far back in the pharynx.	14. Tonsils in fauces.
15. Pharynx has two dorsal ridges.	15. Absent.
16. Absent.	16. Dorsal ridge in nasal tube.
17. Cardiac apex obtuse.	17. More acute.
18. Absent in my specimen.	18. Innominate artery present.
19. Postcava crosses end of abdominal aorta.	19. Postcava conceals posterior half of aorta.
20. Liver more subdivided.	
21. Gall-bladder long and narrow.	21. Short and wide.
22. Right kidney posterior to liver, and each kidney has one conical papilla.	22. Sunk in liver, and each kidney has one broad, flat papilla.
23. Thyroid gland in posterior part of neck.	23. In anterior part.

Phascolarctos.	*Trichosurus.*
24. No thyroid isthmus.	24. Isthmus present.
25. Patella absent.	25. Patella thin and scale-like.
26. Absent.	26. Right lung has an azygos lobe.
27. Two lobes in each lung.	27. Left lung has two, and right has four lobes.
28. Spleen triangular, and has no lateral process.	28. Spleen has a lateral piece.
29. Vertebral arteries arise from subclavian arteries.	29. Vertebral arteries arise from an axis on each side.
30. Intestinal measurements much greater.	

Owen stated that the Koala is the Marsupial which has the greatest claim to typical pre-eminence. MacAlister, on the other hand, showed that it has more individual peculiarities in its myology than has any other Didelphian; and the remarks made in this paper show how many of the appearances of its internal organs are peculiar to itself, for several of those described for *Trichosurus vulpecula* are similar to the conditions present in many Marsupialia. There are also many striking differences between the external and skeletal characters of *Phascolarctos* and those of *Trichosurus*, but I have nothing new to add to existing descriptions.

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EXPLANATION OF THE PLATES.

Plate V.

A. The Palate of *Phascolarctos cinereus* with the cheek-pouches packed with wool and pins in the Eustachian Tubes.

B. The Palate of *Trichosurus vulpecula*.

C. The Palate of *Pseudochirus peregrinus*.

Plate VI.

The Stomach of *Phascolarctos cinereus.*

A. The interior of the stomach.

B. The projection of the pylorus into the duodenum.